

REMARKS

In the Non-Final Office Action, Examiner Cattungal objected to and rejected pending claims 1-20 on various grounds. The Applicant responds to each objection and rejection as subsequently recited herein, and respectfully requests reconsideration of the present application:

- A. Examiner Cattungal objected to 03/08/2010 amendments of independent claim 1, 5 and 13 for introducing new matter into the disclosure

The Applicant has thoroughly considered Examiner Cattungal's remarks concerning the 03/08/2010 amendment of independent claims 1, 5 and 13 for introducing new matter into the disclosure by reciting "sorting being based on at least one similarity of at least one characteristic attribute of the vessel as shown within the further local image and one or more local images of the sequence". The Applicant respectfully traverses this objection of independent claims 1, 5 and 13, because the original disclosure of *U.S. Patent Application Serial No. 10/536,843* unequivocally teaches "sorting being based on at least one similarity of at least one characteristic attribute of the vessel as shown within the further local image and one or more local images of the sequence".

Specifically, on page 2, line 31 to page 3, line 1 of the *U.S. Patent Application Serial No. 10/536,843*, the disclosure recites "The sensor probe is preferably an intravascular ultrasound system (IVUS). Cross-sectional images of the vessel (images perpendicular to the axis of the vessel) can be obtained with an IVUS, with the cross-sections showing characteristic attributes of the vessel (shape and diameter of the lumen, thickness of the walls of the vessel, deposits on the walls of the vessel, surrounding tissue, etc.) at the imaging point." First, this passage explicitly states the cross-sectional images "show" characteristic attributes of the vessel. Second, the examples of the characteristic attributes of the vessel are all attributes that are shown within the images at the imaging point.

Furthermore, on page 7, line 31 to page 8, line 2 of the *U.S. Patent Application Serial No. 10/536,843*, the disclosure recites "Local cross-sectional images 10 are again made with the IVUS probe 3 at the respective points at which the probe 3 is located at the time and are conveyed to the

data-processing unit 7. With the help of suitable gray-value based registration techniques (as described, for example, in: D.L.G. Hill et al., Medical Image Registration, Phys. Med. Biol. 46(3), 2001; J.B.A. Maintz, M.A. Viergever, A survey of medical image registration, Med. Imag. Anal. 2(1), 1998; J. Weese et al., Gray-value based registration of CT and MR images by maximization of local correlation, Proc. of MICCAI 1999, LNCS 1679; T. Netsch et al., Towards real-time multi-modality 3D medical image registration, Proc. of ICCV 2001, IEEE Computer Society) that local image 10' that is most similar to the current cross-sectional image 10 is determined in the sequence making up the roadmap.” First, as known by those having ordinary skill in the art from the above listed references as well as other known sources, gray-value based registration techniques involve calculating the similarity of a pair of images from the gray-values of both images. Second, as known by those having ordinary skill in the art from the above listed references as well as other known sources, the gray-value of images represent the characteristic attribute(s) of the object(s) being shown within the images on a gray color scale.

For example, each local image 5 as shown in FIG. 1 of *U.S. Patent Application Serial No. 10/536,843* shows the characteristic attributes of a vessel 2, and each local image 10 as shown in FIG. 2 of *U.S. Patent Application Serial No. 10/536,843* shows the characteristic attributes of vessel 2. In operation, local images 5 of vessel 2 are generated as probe 3 is being pulled through vessel 2 via a catheter 1, and then stored in sequence in memory 8. Thereafter, for purposes of positioning a stent 11 for treating a stenosis 4, local images 10 of vessel are generated as probe 3 is being pulled through vessel 2 via a catheter 1 and registered with local images 5 as stored in memory. The gray values of each local image 5 as shown in FIG. 1 and each local image 10 as shown in FIG. 2 unequivocally represent the characteristic attributes of the vessel “as shown within” local images 5 and 10, and a gray-value based registration technique of local images 5 and 10 includes a calculation of a similarity of local images 5 and 10 from the gray-values of local images 5 and 10. The most similar local image 10' of local images 5 stored in memory is determined for each local image 10.

Withdrawal of the objection of independent claims 1, 5 and 13 is therefore respectfully requested.

- B.** Examiner Cattungal rejected claims 1-5 and 13-20 under 35 U.S.C. §112, ¶1 as failing to comply with the written description requirement

The Applicant has thoroughly considered Examiner Cattungal's remarks concerning the written description requirement of claims 1-5 and 13-20. The Applicant respectfully traverses this rejection of claims 1-5 and 13-20, because the original disclosure of *U.S. Patent Application Serial No. 10/536,843* provides a written description of "sorting being based on at least one similarity of at least one characteristic attribute of the vessel as shown within the further local image and one or more local images of the sequence".

Specifically, on page 2, line 31 to page 3, line 1 of the *U.S. Patent Application Serial No. 10/536,843*, the disclosure recites "The sensor probe is preferably an intravascular ultrasound system (IVUS). Cross-sectional images of the vessel (images perpendicular to the axis of the vessel) can be obtained with an IVUS, with the cross-sections showing characteristic attributes of the vessel (shape and diameter of the lumen, thickness of the walls of the vessel, deposits on the walls of the vessel, surrounding tissue, etc.) at the imaging point." First, this passage explicitly states the cross-sectional images "show" characteristic attributes of the vessel. Second, the examples of the characteristic attributes of the vessel are all attributes that are shown within the images at the imaging point.

Furthermore, on page 7, line 31 to page 8, line 2 of the *U.S. Patent Application Serial No. 10/536,843*, the disclosure recites "Local cross-sectional images 10 are again made with the IVUS probe 3 at the respective points at which the probe 3 is located at the time and are conveyed to the data-processing unit 7. With the help of suitable gray-value based registration techniques (as described, for example, in: D.L.G. Hill et al., Medical Image Registration, Phys. Med. Biol. 46(3), 2001; J.B.A. Maintz, M.A. Viergever, A survey of medical image registration, Med. Imag. Anal. 2(1), 1998; J. Weese et al., Gray-value based registration of CT and MR images by maximization of local correlation, Proc. of MICCAI 1999, LNCS 1679; T. Netsch et al., Towards real-time multi-modality 3D medical image registration, Proc. of ICCV 2001, IEEE Computer Society) that local image 10' that is most similar to the current cross-sectional image 10 is determined in the

sequence making up the roadmap.” First, as known by those having ordinary skill in the art from the above listed references as well as other known sources, gray-value based registration techniques involve calculating the similarity of a pair of images from the gray-values of both images. Second, as known by those having ordinary skill in the art from the above listed references as well as other known sources, the gray-value of images represent the characteristic attribute(s) of the object(s) being shown within the images on a gray color scale.

Withdrawal of the rejection of claims 1-5 and 13-20 under 35 U.S.C. §112, ¶1 as failing to comply with the written description requirement is therefore respectfully requested.

- C. Examiner Cattungal rejected claims 1-10, 13-16, 18 and 20 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent Publication No. 2005/0107688 to *Strommer* et al.

The Applicant has thoroughly considered Examiner Cattungal’s remarks concerning the patentability of claims 1-10, 13-16, 18 and 20 over *Strommer*. The Applicant has also thoroughly read *Strommer*. To warrant this §102(e) rejection of claims 1-10, 13-16, 18 and 20, each and every element as set forth in the independent claims 1, 5 and 13 must be either expressly or inherently described in *Strommer*. See, MPEP §2131. The Applicant respectfully traverses this §102(e) rejection of independent claims 1, 5 and 13, because *Strommer* fails to describe, expressly or inherently, the following limitations of independent claims 1, 5 and 13:

1. “the sorting being based on at least one similarity of at least one characteristic attribute of the vessel as shown within the further local image and one or more of the local images of the sequence” as recited in independent claim 1;
2. “sorting a further local image, which is made by the sensor probe, into the sequence based on at least one similarity of at least one characteristic attribute of

the vessel as shown within the further local image and one or more of the local images of the sequence” as recited in independent claim 5; and

3. “sorting the further local image into the sequence based on at least one similarity of at least one characteristic attribute of the vessel as shown within the further local image and one or more of the local images of the sequence” as recited in independent claim 13.

As to the traversal, a careful review of *Strommer* reveals *Strommer* teaches delivering a stent (i.e., a medical device as recited in claims 5-20 herein) to a selected position within a lumen (i.e., vessel as recited in claims 1-20 herein) by a graphic designation on an image of the lumen of (1) a selected position of the stent within the lumen and (2) an indication when the stent has reached the selected position. This is accomplished by use of a medical positioning system (“MPS”) constantly detecting the position of the stent relative to the selected position as represented on the image of the lumen. For example as shown in FIG. 6 of *Strommer*, a MPS sensor 210₁ is attached to a catheter 222 delivering the stent, a MPS sensor 210₂ is attached to an image transducer 218, a MPS sensor 210₃ is attached to an operating table, and a MPS sensor 210_N is attached to a patient 216 to thereby constantly detect the position of the stent relative to the selected position. See, *Strommer* at paragraphs [0058] and [0110]-[0116].

Further review of *Strommer* reveals the fact that the only image sorting activity taught by *Strommer* is for purposes of reconstructing a three-dimensional (“3D”) image of a volume from a sequence of two-dimensional (“2D”) images derived from a transducer moving within the lumen and from the 3D location and orientation of the sequence of 2D images obtained from MPS sensors. Specifically, as shown in FIG. 9, *Strommer* teaches an internal transducer 254 (FIG. 7A) for capturing a sequence of 2D images 252A-252S as transducer 254 is moved within a vessel and detected via MPS sensors 258 and 260 (FIG. 7A). The capturing of these 2D images 252A-252S are synchronized with an organ timing signal 272. To reconstruct a 3D image of a volume, the sequence of 2D images 252A-252S is sorted into volumes 274A-274D as shown in

FIG. 10A based on the synchronized timing position of each 2D image relative to an organ timing signal 272. The timing position of each 2D image is either an organ timing signal cycle location T, 1/4T, 1/2T or 3/4T. As shown in FIGS. 10B and 10C, this sorting serves as the basis for the reconstruction and updating of 3D volumes 276 in view of the 3D location and orientation of each 2D image 252 obtained from the MPS sensors 258 and 260. See, *Strommer* at paragraphs [0128]-[0149].

In the context of properly understanding the only sorting activity of *Strommer*, the Applicant respectfully asserts that *Strommer* unequivocally fails to describe, expressly or inherently, sorting a further 2D image into the sequence of 2D images 252A-252S “based on one or more similarities of one or more characteristic attributes of the lumen as shown within the further 2D image and one or more of the 2D images 252A-252S”. For example, *Strommer* unequivocally fails to describe, expressly or inherently, sorting a further 2D image into the sequence of 2D images 252A-252S based on an illustration within the 2D images 252A-252S of a shape and diameter of the lumen, thickness of the walls of the lumen, deposits on the walls of the lumen, and tissue surrounding the lumen as taught by the present application on page 2, line 31 to page 3, line 7. This description failure by *Strommer* is evidenced by the fact that the 2D images 252A-252S shown throughout FIGS. 7B-10C of *Strommer* are void of any illustration of characteristic attributes of the lumen as opposed to the illustration of characteristic attributes of a vessel 2 within local image 5 (FIG. 1) and further local image 10 (FIG. 2) of the present application.

Furthermore, *Strommer* in fact teaches an association of an ECG signal 272 with 2D images 252A-252S that clearly is not shown within 2D images 252A-252S as evidenced by the graphical representation of the association of ECG signal 271 and 2D images 252A-252S. Moreover, in the Non-Final Action, Examiner Cattungal recognizes the fact that ECG signal 272 is not shown within 2D images 252A-252S. See, 03/31/2010 Non-Final Office Action of U.S. Patent Application Serial No. 10/536,843 at paragraph 12.

Withdrawal of the rejection of independent claims 1, 5 and 13 under 35 U.S.C. §102(e) as being anticipated by *Strommer* is therefore respectfully requested.

Claims 2-4 depend from independent claim 1. Therefore, dependent claims 2-4 include all of the elements and limitations of independent claim 1. It is therefore respectfully submitted by the Applicant that dependent claims 2-4 are allowable over *Strommer* for at least the same reason as set forth herein with respect to independent claim 1 being allowable over *Strommer*. Withdrawal of the rejection of dependent claims 2-4 under 35 U.S.C. §102(e) as being anticipated by *Strommer* is therefore respectfully requested.

Claims 6-10 depend from independent claim 5. Therefore, dependent claims 6-10 include all of the elements and limitations of independent claim 5. It is therefore respectfully submitted by the Applicant that dependent claims 6-10 are allowable over *Strommer* for at least the same reason as set forth herein with respect to independent claim 5 being allowable over *Strommer*. Withdrawal of the rejection of dependent claims 6-10 under 35 U.S.C. §102(e) as being anticipated by *Strommer* is therefore respectfully requested.

Claims 14-16, 18 and 20 depend from independent claim 13. Therefore, dependent claims 14-16, 18 and 20 include all of the elements and limitations of independent claim 13. It is therefore respectfully submitted by the Applicant that dependent claims 14-16, 18 and 20 are allowable over *Strommer* for at least the same reason as set forth herein with respect to independent claim 13 being allowable over *Strommer*. Withdrawal of the rejection of dependent claims 14-16, 18 and 20 under 35 U.S.C. §102(e) as being anticipated by *Strommer* is therefore respectfully requested.

- D.** Examiner Cattungal rejected claims 11, 12 and 19 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Publication 2005/0107688 to *Strommer et al.* in view of U.S. Patent Publication No. 2003/0199767 to *Cespedes et al.*

Claims 11 and 12 depend from independent claim 5. Therefore, dependent claims 11 and 12 include all of the elements and limitations of independent claim 5. It is therefore respectfully submitted by the Applicant that dependent claims 11 and 12 are allowable over *Strommer* in view of *Cespedes* for at least the same reason as set forth herein with respect to independent claim 5 being allowable over *Strommer*. Withdrawal of the rejection of dependent claims 11 and 12

under 35 U.S.C. §103(a) as being unpatentable over *Strommer* in view of *Cespedes* is therefore respectfully requested.

Claim 19 depends from independent claim 13. Therefore, dependent claim 19 includes all of the elements and limitations of independent claim 13. It is therefore respectfully submitted by the Applicant that dependent claim 19 is allowable over *Strommer* in view of *Cespedes* for at least the same reason as set forth herein with respect to independent claim 13 being allowable over *Strommer*. Withdrawal of the rejection of dependent claim 19 under 35 U.S.C. §103(a) as being unpatentable over *Strommer* in view of *Cespedes* is therefore respectfully requested.

- E. Examiner Cattungal rejected claim 17 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Publication 2005/0107688 to *Strommer* et al. in of a NPL entitled “Towards Real-Time Multi Modality 3D Medical Image Registration” to *Weese* et al.

Claim 17 depends from independent claim 13. Therefore, dependent claim 17 includes all of the elements and limitations of independent claim 13. It is therefore respectfully submitted by the Applicant that dependent claim 17 is allowable over *Strommer* in view of *Weese* for at least the same reason as set forth herein with respect to independent claim 13 being allowable over *Strommer*. Withdrawal of the rejection of dependent claim 17 under 35 U.S.C. §103(a) as being unpatentable over *Strommer* in view of *Weese* is therefore respectfully requested.

SUMMARY

The Applicant respectfully submits that claims 1-20 as listed herein fully satisfy the requirements of 35 U.S.C. §§102, 103 and 112. In view of the foregoing, favorable consideration and early passage to issue of the present application is respectfully requested. If any points remain in issue that may best be resolved through a personal or telephonic interview, Examiner Cattungal is respectfully requested to contact the undersigned at the telephone number listed below.

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